

New Grass (Poaceae) Records for Singapore, Including *Panicum laxum* New for Asia

HELENA DUISTERMAAT

The Herbarium, Singapore Botanic Gardens,
1 Cluny Road, Singapore 259569

Abstract

Working on a field guide to the grasses of Singapore, 15 records not included in *The Concise Flora of Singapore* were discovered. Eight species and a variety are either recorded for the first time for Singapore, or their presence, which was doubted before, is confirmed. They are: *Cyrtococcum patens* (L.) A.Camus, *Dichanthium annulatum* (Forssk.) Stapf, *Eragrostis cilianensis* (Bellardi) Vignolo ex Janch., *Panicum paludosum* Roxb., *Panicum laxum* Sw., *Paspalum plicatulum* Michx., *Rottboellia cochinchinensis* (Lour.) W.D. Clayton, and *Sporobolus indicus* (L.) R.Br var. *pyramidalis* (Beauv.) Veldt. and *S. tenuissimus* (Schränk) Kuntze. *Panicum laxum* is a new record for Asia. The occurrence of six more species already known from Singapore but not reported in local floras is noted: *Cenchrus echinatus* L., *Digitaria bicornis* (Lam.) Roem. & Schult., *D. mollicoma* (Kunth) Henrard, *Eragrostis brownii* (Kunth.) Nees (including *E. cumingii* Steud. var. *cumingii*), *Panicum trichocladum* Hack. ex K. Schum., and *Urochloa piligera* (F. Muell. ex Benth.) R.D. Webster. For the sake of completeness, they are included with a short discussion.

Introduction

Ridley (1907) provided the first account of the grass family (Poaceae) for Malaya (including Singapore), followed much later by Gilliland (1971). Recently, Keng *et al.* (1998) summarised the family for Singapore. The keys provided in all works (in the latter unfortunately not to the species level) are very technical. Also, some quite common species rarely seem to flower in Singapore. They cannot be identified with the available literature. To tackle the diverse identification problems that exist, I am working on a field guide to the grasses of Singapore (excluding the woody bamboos). During the course of this project, I came across 15 new records, not mentioned or accepted in Keng *et al.* (1998). The species belong to the genera *Cenchrus*, *Cyrtococcum*, *Dichanthium*, *Digitaria*, *Eragrostis*, *Panicum*, *Paspalum*, *Rottboellia*, *Sporobolus* and *Urochloa*. The presence in Singapore of some of them had already been mentioned by others, but for the sake of completeness they are included here. The species are discussed in alphabetical order.

Cenchrus

In Keng *et al.* (1998), *Cenchrus brownii* Roem. & Schult. was considered in the wider sense, including *C. echinatus* L. Veldkamp (1999) accepts both

species, and confirms the latter for Singapore. Both species are weeds of ruderal places, native to America. Although *Cenchrus brownii* was first recorded for Singapore (Sinclair SFN 38881, 1950), it is now more rare than the more recently introduced *C. echinatus* (first collected in 1994). Both have spikelets in groups (or burs) surrounded by a dentate involucre, with the burs arranged on a single common axis.

Key to the *Cenchrus* species of Singapore

- 1a. Burs 1–2 mm apart, spines at base slender, 0.1–0.2 mm wide, erect, 2–4 (–7) mm long, apical lobes at margin with hairs up to 0.5 mm long. Spikelet 4–5 mm long. *C. brownii*
- 1b. Burs 1.5–4.0 mm apart, spines at base stout, 0.3–0.5 mm wide, recurved, up to 4 mm long, apical lobes at margin with at least few hairs 1.0–1.5 mm long. Spikelet 5–6.2 mm long. *C. echinatus*

Cenchrus echinatus L.

Singapore collections (in SING unless indicated otherwise): Ali Ibrahim & Chin AI223 (1994) Armenian Street; Ali Ibrahim AI224 (1994) Bedok Road, Bedok Corner; Tan *et al.* 2043a (1996) Pulau Tekong (SINU). Teo TM11 (2000) Tanah Merah (SINU). Samsuri, A. *et al.* 290 (2002) Pulau Tekong; Duistermaat S120 (2003) Pulau Ubin, near Jetty, ruderal place on sandy soil, unshaded; S149 (2003) Orchard Road, next to Specialist Shopping Centre, ruderal open place, shaded; S224 (2003) Cluny Road, recently replanted flowerbed with fertile, humus-rich soil, partly shaded; S230 (2003) Labrador Villa Road, edge of field, unshaded.

Cyrtococcum

Keng *et al.* (1998) mentioned two species of *Cyrtococcum* for Singapore, *C. accrescens* (Trin.) Stapf and *C. oxyphyllum* (Steud.) Stapf. A third species, *C. patens* (L.) A. Camus, was mentioned for Malaysia, in shady places, but not for Singapore (Gilliland, 1971). I found collections from 1993 onwards of *C. patens* in the herbaria of both SING and SINU, and collected it in secondary to primary forest in Singapore.

Key to the *Cyrtococcum* species of Singapore (Veldkamp, pers. comm.).

- 1a. Longest pedicel of the pair shorter than spikelet. Inflorescence contracted. *C. oxyphyllum*
- 1b. Longest pedicel of the pair longer than spikelet. Inflorescence more open.

2a. Erect part of culms 30–100 cm long. Sheath usually pilose all over. Panicle 20–50 by 6–30 cm. Spikelets usually 1.35–1.5 mm long.

C. accrescens

2b. Erect part of culms 10–30 cm long. Sheath usually pilose along margins only. Panicle 3–18 by 0.8–2.3 cm. Spikelets usually 1.5–1.8 mm long.

C. patens

***Cyrtococcum patens* (L.) A.Camus**

Culm with erect part 10–30 cm tall. Nodes hairy on one side. Sheath with hairy margins only. Ligule 0.4–0.8 mm long, membranous. Blade 4–7 cm long, 5–8 mm wide, base at margin with up to 4 mm-long bulbous-based hairs. Mature inflorescence 4–9 by 1–2.3 cm. Longest pedicel of the pair 2.5–4.0 mm long. Spikelet 1.5–1.8 mm long, 0.9–1.0 mm wide.

Singapore collections: Chua *et al.* H135 (1993) Pulau Hantu (SINU). Lai & Saifudin LJ549 (1999) Loyang Avenue, back mangrove (SINU). Duistermaat S176 (2003) Pulau Ubin, E of Kampong Melayu, abundant along paths and open patches in old rubber plantation with remnants of old forest on top of the hill; S219 (2003) Bukit Timah Nature Reserve, Senapang Road, shaded roadside in secondary forest; S226 (2003) Pulau Ubin, Jalan Ubin, secondary forest (SING).

Another specimen, Wong *P.W. s.n.* (1959; SINU) is intermediate between *C. accrescens* (sheath sparsely hairy all over, panicle 20–35 cm long) and *C. patens* (spikelet 1.6–1.7 mm long). It could either be a hybrid, or a form of *C. accrescens* with unusually small spikelets.

Dichanthium

Although Gilliland (1971) mentioned *Dichanthium annulatum* (Forssk.) Stapf for Singapore, Keng *et al.* (1998) did not include it, because they had not seen any Singapore material. The species is different from both *D. caricosum* (L.) A. Camus and *D. mucronulatum* Jansen in having an inflorescence with 3–5 racemes (only 1 raceme in the other two). Superficially, it resembles a poorly developed *Bothriochloa bladhillii*, the inflorescence of which as a rule has more than 10 racemes. Moreover, the racemes and pedicels are furrowed in the latter, not so in *D. annulatum*. I was able to identify collections as *D. annulatum* both in SING and SINU, and made three collections (all from one area) in Singapore.

This species of Palearctic origin is mainly a roadside ruderal. Because of its tufted habit with rather long and tough decumbent culms, it can be a nasty weed in lawns.

Dichanthium annulatum (Forssk.) Stapf

50–200 cm tall. Tufted, decumbent. Nodes hairy. Sheath 3–7 cm long, glabrous, slightly compressed, not keeled, margin glabrous. Ligule 1.5 mm long, hairy, membranous. Blade 7–17 cm long, 3–6 mm wide, hairy at least on upper side, base rounded, with a few up to 5 mm-long hairs. Inflorescence with 3–5 simple racemes, 3.5–7 cm long, axils hairy. Spikelets in pairs, one sessile, one pedicelled. Pedicel 1.8–2.0 mm long, somewhat flattened but not furrowed, hairy on one margin. Sessile spikelet 3.5–3.9 mm long, 1.0–1.2 mm wide, dorsiventrally flattened, 2-flowered, awned; both lowest bracts (glumes) as long as the spikelet. Awn 2–2.5 cm long. Pedicelled spikelet reduced to 2 glumes.

Singapore collections: Teruya 2012 (1932) Newton (SING). Sinclair SFN 39429 (1951) Tanjong Pagar Docks (SING). Wong P.W. s.n. (1959) General Hospital grounds (SINU). Sinclair SFN 10784 (1965) Tanjong Pagar, Nelson Road (SING). Ali Ibrahim AI337 (1998) Upper East Coast Road (SING). Lai LJ498 (1999) Tanglin, Dempsey Road, Civil Service Club (SINU). Duistermaat S16 (2002) Mount Sinai Drive, shaded grassy roadside; S25 (2002) Mount Sinai Drive, grassy roadside, partly shaded, frequently mown; S118 (2003) Mount Sinai Drive, on 300 cm high stone wall in backyard, unshaded (SING).

Digitaria

The genus *Digitaria* comprises worldwide c. 170 species, the delimitation of which has long been a problem. For the 27 Malesian species, there is the revision by Veldkamp (1973). The treatment of the genus in Keng *et al.* (1998) obviously follows this revision. However, they did not include *D. bicornis* (Lamk.) Roem. & Schult. and *D. mollicoma* (Kunth) Henr., although in the revision the first was recorded as ‘throughout Malesia’ and the latter as ‘Singapore [among others]’. Material of both species is present in both SING and/or SINU, and I collected them recently as well. Veldkamp (*pers. comm.*) provided a separately distributed identification list of the specimens he had examined, including those from SING. An updated list is given here.

Digitaria bicornis is a species from waste places, often on sand, also along the shore. Its recorded presence on the island dates back to the 19th century. The paired spikelets are heteromorphous, i.e. sterile lemma of the sessile spikelet glabrous with nerves equidistant to slightly pubescent with nerves not equidistant, that of the pedicelled spikelet always more pubescent to bristled, nerves not equidistant; if basal spikelets homomorphous, then completely glabrous. In Singapore there is only one other taxon with heteromorphous spikelets, *D. setigera* Roem. & Schult. var. *calliblepharata*

(Henr.) Veldk. The two can be separated by the absolute and relative length of the upper glume: 1–2.75 mm long and 0.35–0.8 times as long as the spikelet in *D. bicornis*, versus 0.3–1 mm long and 0.15–0.3 times as long as the spikelet in *D. setigera* var. *calliblepharata* (Veldkamp, 1973, *pers. comm.*). *Singapore collections* (all in SING): Ridley *s.n.* (1890) Changi. Burkill 4669 (1919) Tanah Merah Besar. Teruya 2221 (1932) Newton. Corner *s.n.* (1941) Yio Chu Kang (Veldkamp det. as *D. nuda*). Duistermaat S142 (2003) Gim Moh, raised flowerbed, unshaded; S184 (2003) Pulau Ubin, Chek Jawa, house no 1, 'The English House', on rock facing the sea; S217 (2003) East Coast Park; S253 (2003) Sarimbun, Jalan Bahtera, grassy roadside, under trees, in shade.

Digitaria mollicoma, like *D. longiflora* (Retz.) Pers., is a stoloniferous, mat-forming grass with spikelets in groups of three. Both grow on open, shaded to unshaded, humid, sandy to rocky soil. Both species seem to be fairly recent introductions to Singapore, the oldest record is from 1955 for the first, 1958 for the latter (*H.B. Gilliland* 1782). The two differ in the length of the spikelets, relative length of the upper glume, and the positioning of the veins on the sterile lemma (Veldkamp, 1973, *pers. comm.*):

- 1a. Spikelets 1.8–2.5 mm long. Upper glume 0.7–1 times as long as the spikelet. Sterile lemma with 7 more or less equidistant veins. *D. mollicoma*
- 1b. Spikelets 1.3–1.7(–1.9) mm long. Upper glume as long as the spikelet. Sterile lemma with 5–7 more or less inequidistant veins. *D. longiflora*

Singapore collections: Abu Kassim *s.n.* (1955) Bedok roadside (SINU); 1754 (1958) University grounds. Jumali K994 (1964) Botanic Gardens, near the pond (SINU). Chan *s.n.* (1984) NUS, Kent Ridge Campus, waste ground (SINU). Lai LJ493 (1999) junction of Sembawang Road and Gambas Ave, open waste ground (SINU). Duistermaat S31 (2002) Holland Road, inclined verge with grass vegetation, shaded; S160 (2003) Upper Pierce Reservoir, dirt road through forest, in low vegetation on wet soil along free running streamlet; S240 (2003) Pulau Subar Laut (Big Sisters Island), sandy soil just above high water-line, underneath coconut trees (SING).

Eragrostis

The delimitation of the species of *Eragrostis* (c. 350 species worldwide) is troublesome. However, for the Malesian region they were recently revised by Veldkamp (2002), who clarified many problems. Most of the names he mentions for Singapore are included in Keng *et al.* (1998), although the delimitation is different in a few cases. Most dramatic is the change in the *E. atrovirens-elongata* complex. The name *E. elongata* (Willd.) J.Jacq., now to be regarded as a synonym for the E. Malesian-Australian *E. diandra* (R.Br.) Steud., appears

to have been widely used for other taxa in Singapore including *E. atrovirens* (Desf.) Trin. ex Steud., *E. brownii* (Kunth.) Nees and *E. cumingii* Steud. var. *cumingii*. The last two, not mentioned in Keng *et al.* (1990), are not easily distinguished. The discriminating character is in the length and shape of the anthers, and to a lesser extent also in the colour of the pericarp (Veldkamp, 2002): anthers 0.1–0.2 mm long, globose, and pericarp cinnamon-coloured in *E. cumingii* var. *cumingii*, versus anthers 0.3–0.4 mm long, ellipsoid, and pericarp dark tea-coloured, rarely cinnamon-coloured as in *E. brownii*. However, in the Singapore material the anthers are never globose (1.6 to 3.0 times as long as wide), the length of the anthers ranges continuously between 0.15 and 0.34 mm, and differences in the colour of the pericarp do not correspond with this. I have therefore decided to treat the Singapore material as one species, *E. brownii* in the wider sense (*s.l.*). It is distinguished from the other Singapore species by the persistent paleas and the jointed rachilla that will ultimately break up from above downward. It was collected for the first time in 1930, and is today rather common, also in the urban environment.

Eragrostis brownii s.l.

Singapore collections (not already cited in Veldkamp, 2002; herbarium only mentioned if not SING): *Teruya* 1299 (1930) Geylang, *Teruya* 2023 (1932) Newton. *Teo* TM30 (2000) Tanah Merah (SINU). *Samsuri et al.* 44 (2001) Pulau Tekong. *Duistermaat* S4 (2002) Mount Sinai Drive, road side and between pavement; S24 (2002) Holland Road area, Mount Sinai Rise, bank of terrace house, with grass vegetation; S53 (2002) Sungei Kadut area, Mandai Quarry, off Woodlands Road, waterlogged soil; S68 (2002) Sungei Buloh, on gravel path, unshaded, low density vegetation; S145 (2003) Holland Road area, Mount Sinai Drive, bank of terrace house, with grass vegetation, unshaded; S185 (2003) Pulau Ubin, Chek Jawa, house no 1, 'The English House', between cracks of staircase leading to private jetty; S213 (2003), N-side of Sultan's Land, off Gallop Road, steep slope with seepage water, low and dense vegetation, unshaded; S256 (2003) Sarimbun, Bahtera Track, sunny roadside on sandy clay.

Furthermore, the collections in SING revealed, rather surprisingly, an old collection of *E. cilianensis* (Bellardi) Vignolo ex Janch. (*Corner s.n.*, 1941, Yio Chu Kang; Veldkamp det. as *E. unioides*, but lemmas lack the granular structure that is typical for this species). The species is recognised by its persistent paleas and the presence of obvious glands on leaf sheath and blade. In Malesia, it is recorded as a weed of waste places, especially in regions with a distinct dry season, from the Philippines, Java, Lesser Sunda Islands, Moluccas, and introduced in New Guinea (Veldkamp, 2002). However, the species does not seem to be part of the present day flora of Singapore.

Panicum

With 450 species worldwide, the genus *Panicum* is one of the largest within the grass family (Poaceae). Only 26 species occur in the Malesian region (Veldkamp, 1996, 1999). According to Aliscioni *et al.* (2003, and references therein), *Panicum* is a polyphyletic group. They propose a new generic delimitation and divide *Panicum* into various genera (with a number of sections still as *incertae sedis*). Because many of the Malesian species were not included in the analysis, I prefer to consider their results as preliminary. I therefore retain *Panicum* with its traditional delimitation (Aliscioni *et al.*, 2003). The genus is recognized by a lax to dense panicle with rounded to triquetrous branches. The spikelets are 2-flowered and unawned with the upper glume as long as the spikelet.

Six species of *Panicum* were confirmed by Keng *et al.* (1998) based on Veldkamp (1996). *Panicum trichocladum* Hack. ex K.Schum. was confirmed by Veldkamp (1999), whereas material of one more *Panicum* species was found in the herbarium, and a third species was collected in the field. *Panicum* is now represented by nine species in Singapore.

Panicum trichocladum, when present, is often abundant, scrambling through shrubs up to 3 m high. Its diagnostic features include ligule membranous, ciliolate, panicle branches at base without spikelets, lower glume 0.3–0.6 mm long and 0.1–0.2 times as long as the spikelet, and 2nd lemma apiculate and incurved. It has been collected from three localities in 1998 (specimens cited in Veldkamp, 1999), and more recently in the secondary forest between Holland Road and Tyersall Avenue (*Duistermaat* S200, 2003; SING), and inside Bukit Timah Nature Reserve, Senapang Link (*Duistermaat* S220, 2003; SING).

In the collections of SINU, I found two specimens of *Panicum paludosum* Roxb. This species is similar to *P. repens* L. in having a collar-shaped lower glume, but differs in having an entirely glabrous sheath and blade, and the sterile lower floret without a palea or, when present, up to 0.7 times as long as the lemma, while *P. repens* has a male lower flower with the palea more than 0.8 times as long as the lower lemma. It also has larger spikelets (3.3–4.5 mm long against 2.6–3.25 mm; see Veldkamp, 1996). *Panicum paludosum* is an aquatic species, favouring shallow waters, whereas *P. repens* usually grows in terrestrial conditions and is only able to survive inundation temporarily (Gilliland, 1971). Its presence in Singapore is a little surprising, as in Malaysia *P. paludosum* is known only from the northern and central states of Kedah (including Langkawi), Pahang and Penang. In Indonesia, the nearest localities are in Sumatra and Borneo. The oldest Singapore collection is from 1959 (Wong P.W. *s.n.*, Tampines, floating in water). The second and newest collection is from 1965 (Keng *et al.* *s.n.*, unfortunately without locality). Although I have not seen the species on my collecting trips, it could still be present in shallow waters.

In 2002, I found a delicate, c. 20 cm high grass with minute spikelets c. 1.3 mm long. It grew on a shaded roadside with rather dense, lawn-like vegetation. At the time I could only identify it to *Panicum*. Later, on a field trip with Tan Kai Xin (NUS) on Coney Island (Pulau Serangoon), I found a similar plant growing near the coast on the reclaimed part of the island, on coarse sand in rather open, unshaded vegetation. Finally, I discovered along Clementi Road a third population of over a hundred plants in an open field with clayey, waterlogged soil, and a fourth of some tens of plants on the shaded roadside along Seletar West Farmway 1 (off Jalan Kayu). Bor (1960) and Veldkamp (1996, 1999) do not list the species, and even the World Grass Species Database at the Kew website (<http://www.rbgkew.org.uk/data/grasses/grasses.ink>) yielded only a single, but not identical species. Finally, Hitchcock & Chase (1910, 1915) and Hepper (1972) lead beyond doubt to *P. laxum* Sw. A recent revision of section *Laxa* (Zuloaga *et al.*, 1992) resulted in the same positive identification.

The species is widely distributed in America from Mexico to Argentina, where it is common in wet and open, disturbed places, margins of roads, swamps and rivers, at altitudes of 0–1500 m. During the early 20th century, the species was introduced to West Africa (first collected in 1927) and is there now naturalized on roadsides and in clearings, particularly on damp soil. Later, it was also found in Australia (Simon, 1992, as *Cliffordiochloa parvispiculata* and Simon, 2003, as *Steinchisma laxa*), confined to water channels (Queensland). As far as I know, this is the first time *Panicum laxum* is recorded for Asia. Its habitat in Singapore is comparable to where it is found in Africa, but the Singapore plants seem to be smaller. *Duistermaat* S37 is different from the other two collections in being single and prostrate, rather than tufted and geniculate. It could be the cv. 'Shadegro', a form with a potential as a turf grass for shaded conditions, which is established in the Brisbane Botanic Gardens (Simon, 2003).

Panicum laxum is more closely related to the Asian *P. auritum* (also occurring in Singapore, and the only two species of section *Laxa* occurring in Malesia) than to any of the other species occurring in Malesia. The two can be separated as follows:

- 1a. Plant 80–120 cm tall. Leaf sheath and blade without transverse veinlets. Spikelet 2.0–3.0 mm long. Upper glume and 1st lemma with (faint) transverse veinlets. 1st palea up to 0.75 times as long as 1st lemma.
P. auritum
- 1b. Plant 20–45 cm tall. Leaf sheath and blade with minute transverse veinlets. Spikelet 1.3–1.4 mm long. Upper glume and 1st lemma without transverse veinlets. 1st palea as long as 1st lemma.
P. laxum

Panicum laxum Sw.*(Steinchisma laxa* (Sw.) Zuloaga)

Culms 20–45 cm tall. Single or tufted, geniculate to prostrate. Nodes glabrous. Sheath glabrous, with minute transverse veins, margin hairy at apex or upper half only. Ligule 0.3–0.4 mm long, membranous, fimbriate. Blade 4–7 cm long, 2–5 mm wide, glabrous. Inflorescence 5–13 cm long, 3–10 branches scattered along rachis, patent, longest branch 2.5–6.0 cm long, branchlets appressed to 1st order branch. Pedicel 0.5–1.0 mm long. Spikelet 1.3–1.4 mm long, 0.7 mm wide, obtuse. Lower glume 0.5–0.6 mm long, 0.5 times as long as the spikelet, glabrous, 3 veins. Upper glume 1.2 mm long, glabrous, 5 veins. 1st lemma as upper glume, 1.2–1.3 mm long, 3 veins, obtuse to acute. 1st palea 1.2–1.3 mm long.

Habitat in Singapore: Open to shaded roadside or field, on clayey or sandy soil.

Singapore specimens: *Duistermaat* S37 (2002) Holland Grove Road, Henry Park Apartments, roadside lawn, shaded (SING, L). *Duistermaat* NUS 1269 (2003) Coney Island, raised bank of reclaimed area near the coast, on coarse sand in rather open and unshaded vegetation. (SINU, L). *Duistermaat* S285 (2004) Clementi Road, at junction with Dover Road, open field on waterlogged, clayey soil, more than 100 plants; S287 (2004) Seletar West Farmway 1, on shaded roadside on clayey soil, some tens of plants.

Paspalum

The collections in SINU include one specimen of *Paspalum plicatulum* Michx. (*Teo* L3 (2000) Lazarus Island). The species is readily recognised by a conspicuous dark centre on the oblong to (ob-)ovate, paired spikelets. It is native to America, and has been found several times in northern Australia (Mallett & Orchard, 2002: p. 348). It was found in Malesia only once, in a cultivation plot in Papua New Guinea (De Koning & Sosef, 1985: p. 313, and included in their key to the Malesian species). Plants are cultivated for their high palatability to cattle in (sub-)tropical America (known as Brownseed *Paspalum*), the Chinese province of Gansu (Chen & Phillips, undated), and Papua New Guinea (De Koning & Sosef, 1985). It remains to be seen if this species will establish itself in Singapore.

Rottboellia

In the collections of SINU, I found a specimen (*Chua et al.* 1074) that, with its 80 cm-long culms growing in tufts and with several spike-like racemes from a single culm, superficially resembles *Mnesithea glandulosa*. With this species it also shares the sessile spikelets with winged lower glumes, and the sterile pedicelled spikelets (Veldkamp *et al.*, 1986), but the gland-like warts on the margins of the lower glumes of the sessile spikelets, which are characteristic for this species, are lacking. Moreover, the male 1st floret of the sessile spikelet,

and the sheaths with bulbous-based hairs speak more for *Rottboellia cochinchinensis* (Lour.) W.D. Clayton (Veldkamp *et al.*, 1986). Thus, the specimen is intermediate between the genus *Mnesithea* and *R. cochinchinensis*. In SING, I found a second intermediate specimen (Samsuri *et al.* 315), but this one has unwinged lower glumes, a less inflated rachis, and sterile pedicelled spikelets of only 2 glumes. Earlier, an intermediate specimen from the Philippines was described as *Rottboellia paradoxa* Koning & Sosef (Veldkamp *et al.*, 1986), but here the pedicels are only partly fused with the rachis; they are completely fused in the Singapore material. All intermediate specimens are different from each other. Study of the Malesian collections of *R. cochinchinensis* in SING revealed that this species is probably much more variable than earlier thought. I therefore keep both Singapore specimens under this name. Because both were collected on recently reclaimed land, it remains to be seen whether the species will become established in Singapore.

Rottboellia cochinchinensis (Lour.) W.D. Clayton

R. exaltata L.f. (see Clayton, 1981)

Culms up to 80 cm tall, tufted. Nodes glabrous. Sheath 6–7 cm long, with bulbous-based hairs, rounded, margin hairy. Ligule 1.5 mm long. Blade 21–45 cm long, 11 mm wide. Inflorescence spike-like raceme, 5–7 cm long, several from 1 stem, basal part internode flattened, 2–3.8 mm wide, upper part rounded, 2–4.5 mm wide. Spikelets in pairs, 1 sessile, 1 pedicelled; pedicel glabrous, one side completely fused with rachis; sessile spikelet 4.5–5.0 mm long, 1.7–4 mm wide, 1st floret male. Lower glume granulate, margin smooth, apex unwinged or with indurated wings. Pedicelled spikelet c. 4.5 mm long, of two reduced, herbaceous, flat glumes, 0–2 smaller hyaline bracts inside.

Habitat in Singapore: Open wasteland on sand near the coast, waterlogged, unshaded.

Singapore specimens: Chua *et al.* 1074 (1995) Marina East, reclaimed land (SINU). Samsuri *et al.* 315 (2002) Pulau Tekong, reclaimed land (SING).

Sporobolus

In mid-2003, a small-tufted grass with lax panicles attracted my attention. I have found it several times in Singapore, on roadsides, in flower beds and flower pots. The species is not mentioned in Gilliland (1971) or Keng *et al.* (1998). The keys in Bor (1960), however, lead to *Sporobolus tenuissimus*, a species native to tropical Africa, America, and India. Introduction of the species with potting mix or garden material is obvious.

Baaijens and Veldkamp (1991) already noticed that this species had been introduced into other regions in Asia (Vietnam, Indonesia: Java). It seems to be spreading (rapidly) in India (Sreekumar, 1994), Indonesia (Veldkamp, 1997) and Thailand (Veldkamp, 2003). We should therefore expect to see more of this species in Singapore and Malaysia; it could even spread to everyone's highrise garden!

The plant superficially resembles *Eragrostis amabilis* (L.) Wight & Arn. ex Nees, with which it was found growing, in the panicle shape and in the hyaline parts of the spikelet. It immediately stood out because of the strictly erect stems (prostrate to ascending in *E. amabilis*) and the 1-flowered spikelets (vs. 3–6-flowered).

During fieldwork with H.T.W. Tan *et al.*, I found a few plants of *Sporobolus indicus* (L.) R.Br. that seemed particularly tall. For that reason I collected them, and checking with Baaijens and Veldkamp (1991) they appeared to be *S. indicus* var. *pyramidalis* (Beauv.) Veldk., a taxon from Africa and S. America. Because it had been reported for Australia and the Pacific they suggested it might turn up in Malesia. Veldkamp (*pers. comm.*) was able to confirm this identification and that it is the first record of the variety for Malesia.

Key to the *Sporobolus* species and varieties in Singapore

(after Baaijens and Veldkamp, 1991)

- 1a. Stoloniferous plants. Lower glume 0.55–0.9 times as long as spikelet, upper glume 0.75–1 times as long. *S. virginicus*
- 1b. Tufted plants. Lower glume 0.2–0.5 times as long as spikelet, upper glume up to 0.67 times as long. 2
- 2a. Spikelet 0.9–1.25 mm long; pedicel 2–6 mm long. Lemma and palea hyaline. *S. tenuissimus*
- 2b. Spikelet longer than 1.25 mm; pedicel less than 1 mm long. Lemma and palea herbaceous. 3
- 3a. Upper glume truncate, less than half as long as the spikelet, slightly longer than the lower glume. (Spikelets 1.7–2.2 mm long. Anthers 3). *S. indicus* var. *pyramidalis*
- 3b. Upper glume more or less acute, 0.4–0.67 times as long as spikelet, distinctly longer than the lower glume. 4
- 4a. Panicle usually somewhat lax and branches with loose spikelets. Spikelets usually 1.4–1.6 mm long. Anthers usually 2, 0.5–0.8 mm long. Seed 0.6–0.9 mm long. *S. indicus* var. *flaccidus*
- 4b. Panicle usually contracted and branches with dense spikelets. Spikelets usually 1.8–1.9 mm long. Anthers usually 3, 0.7–1 mm long. Seed 0.9–1.1 mm long. *S. indicus* var. *major*

Sporobolus indicus (L.) R.Br. var. *pyramidalis* (Beauv.) Veldk.

Plant 1.55 m high, tufted. Culm erect. Spikelet 1.9 mm long. Lower glume 0.3 mm long, truncate. Upper glume 0.6 mm long, truncate. Anthers 3, 0.9 mm long. *Habitat in Singapore*: Unshaded, open vegetation, sandy soil.

Singapore specimens: Duistermaat and Tan *et al.* S304 (2004) 38x39 Neo Tiew Crescent, open field of private company (SING, duplicated in L, living collection in SINU).

Sporobolus tenuissimus (Schränk) Kuntze

Plant 20–70 cm high, single or in small tufts. Culm erect. Nodes glabrous. Sheath and blade glabrous. Ligule 0.2 mm long, fimbriate. Blade up to 14 cm long, 2 mm wide. Inflorescence a lax panicle, 15–36 by 4–6 cm, longest branches 4 cm long, glabrous, very thin, with secondary branchlets. Spikelets well-spaced, pedicelled, single, 1-flowered, 1.3 mm long, hyaline. Both glumes much shorter than spikelet. Anthers 0.3–0.4 mm long.

Habitat in Singapore: In flowerbeds and on roadsides, open vegetation, unshaded. Seems to be associated with *Eragrostis amabilis*.

Singapore specimens (all in SING, duplicated in L): *Duistermaat* S131 (2003) as a weed in potted plant at 56 Mt. Sinai Drive; S223 (2003) Bukit Timah campus of Singapore Management University, flowerbed with fertile humus-rich soil, unshaded; S259 (2003) Waterloo Street, near the church of St Peter & St Paul, on sandy roadside with cement and brick debris, unshaded; S260 (2004) Cluny Road, in unshaded flowerbed with clayey sand.

Urochloa

Veldkamp (1999) noticed that besides the three *Urochloa* species mentioned in Keng *et al.* (1998), a fourth, *U. piligera* (F. Muell. ex Benth.) R.D. Webster, is present in Singapore. Like *U. subquadrifida* (Trin.) R.D. Webster, spikelets are solitary, and the lower glume has overlapping margins (Veldkamp, 1996). It is immediately recognised as different, however, because of the hairy upper glumes (glabrous in the latter). It is native to Australia and east Malesia (Sulawesi to New Guinea), where it grows in open sandy places near the seashore, and in dry rice fields. The first records for Singapore (1959, specimens in SINU, cited in Veldkamp, 1999), were found inland, in swampy places, on the bank of a canal and on a roadside. It was not collected again, until in 2002 I found the species in Sungei Buloh (*Duistermaat* S72), and in 2003 in Sarimbun (*Duistermaat* S243; collections in SING). In both places it grew on dry to damp roadsides on sandy clay in coastal areas on the northwest of the island, a habitat comparable to its native one.

Acknowledgements

I thank Dr J.F. Veldkamp for his enthusiastic support of the project, his updated identification keys for Flora Malesiana, and for the confirmation of the identification of *Panicum laxum* and *Sporobolus indicus* var. *pyramidalis* and *S. tenuissimus*. Singapore Botanic Gardens (Dr S.C. Chin), SING (Dr R. Kiew and staff), and SINU (especially Prof H.T.W. Tan, Ms Morgany, and Mr Chua) are gratefully acknowledged for their hospitality. It was a great pleasure to be in the field with Tan Kai Xin, who also helped me in the library. Joseph Lai and Keith Hillier accompanied me in Sungei Buloh. The staff of the SING

herbarium (Serena Lee, Paul K.F. Leong, Samsuri Ahmad) and Ali Ibrahim (NParks) allowed me to join them on their trip to Pulau Ubin. All these people have motivated me to continue the project on the grasses of Singapore, for which I am grateful.

References

- Aliscioni, S.S., L.M. Giussani, F.O. Zuloaga and E.A. Kellogg. 2003. A molecular phylogeny of *Panicum* (Poaceae: Paniceae): tests of monophyly and phylogenetic placement within the Panicoideae. *American Journal of Botany*. **90**: 796–821.
- Baaijens, G.J. and J.F. Veldkamp. 1991. *Sporobolus* (Gramineae) in Malesia. *Blumea*. **35**: 393–458.
- Bor, N.L. 1960. *The Grasses of Burma, Ceylon, India and Pakistan*. Pergamon Press, Oxford, London, U.K.
- Chen, S. and S.M. Phillips. Undated. http://www.fna.org/china/mss/volume22/hum_21_Paniceae.htm#tribe
- Clayton, W.D. 1981. Notes on the tribe Andropogoneae (Gramineae). *Kew Bulletin*. **35**: 813–818.
- Koning, R. de and M.S.M. Sosef. 1985. The Malesian species of *Paspalum* L. (Gramineae). *Blumea*. **30**: 279–318.
- Gilliland, H.B. 1971. *Revised Flora of Malaya. 3: Grasses of Malaya*. Government Printing Office, Singapore.
- Hepper, F.N. 1972. *Panicum* Linn. *Flora of West Tropical Africa*. **3**: 426–435.
- Hitchcock, A.S. and A. Chase. 1910. The North American species of *Panicum*. *Contributions from the United States National Herbarium*. **15**: 1–396.
- Hitchcock, A.S. and A. Chase. 1915. Tropical North American species of *Panicum*. *Contributions from the United States National Herbarium*. **17**: 459–539.
- Keng, H., S.C. Chin and H.T.W. Tan. 1998. Gramineae. *The Concise Flora of Singapore, Monocotyledons*. **2**: 145–188.
- Mallett, K. and A.E. Orchard (eds). 2002. Poaceae 1: Introduction and Atlas. *Flora of Australia*. **43**: 1–319.
- Ridley, H.N. 1907. Gramineae. *Materials for a Flora of the Malay Peninsula*. **5**: 118–197.
- Simon, B.K. 1992. Studies in Australian grasses 6. *Alexfloydia*, *Cliffordiochloa* and *Dallwatsonia*, three new panicoid grass genera from eastern Australia. *Austrobaileya*. **3**: 669–681.